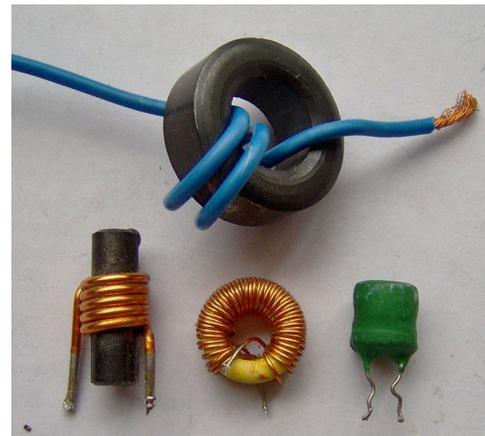


# Capacitors and inductors

1. New circuit elements that are able to store energy  
Dynamic elements, i.e., they change with time
2. Allow to design circuits that perform integration and differentiation  
Make possible signal processing operations in modern communication and audio equipment



# Capacitors

Defining relationship for the capacitor



$$q(t) = Cv_C(t)$$

C is capacitance, unit is farad (F), range  $10^{-12}$  -  $10^{-3}$

i-v relationship

$$i_C(t) = dq/dt = Cdv_C/dt$$

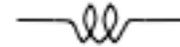
If  $v_C$  is constant then  $i_C=0$ . Capacitor behaves as open circuit under dc excitations

Power

$$p_C(t) = C/2 dv_C^2/dt$$

# Inductors

Defining relationship for the inductor



$$\lambda(t) = Li_L(t), \lambda(t) \text{ is flux linkage}$$

L is inductance, unit is henry (H), range  $10^{-6}$  -  $10^{-3}$

i-v relationship

$$v_L(t) = d\lambda / dt = L di_L / dt$$

If  $i_L$  is constant then  $v_L = 0$ . Inductor behaves as short circuit under dc excitations

Power

$$p_L(t) = L/2 di_L^2 / dt$$